DISEASE DETECTION SURVEY
Air Pollution

Navajo Mountain
Navajo Indian Reservation
Arizona

Forest Insect and Disease Management Branch
Division of Timber Management
Southwestern Region, USDA, Forest Service
517 Gold Avenue, SW
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In June and October 1971, Robert Loomis, plant pathologist in the Forest Service Insect and Disease Management Branch, examined trees and associated vegetation on Navajo Mountain, Arizona. The purpose of the survey was to make note of tree and plant condition on selected areas of Navajo Mountain prior to the scheduled 1974 operation of the Navajo Electrical Generating Station, located near Page, Arizona. No leaf or needle abnormalities were noted which might later be confused with symptoms of possible SO_2 injury. The most prevalent forest disease agent noted in the area was southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) on ponderosa pine.

Method.--A preliminary detection system, consisting of one sulfation plate station and three vegetative observation areas, was initiated in June 1971. Foliage of trees and associated plants was examined for abnormalities caused by insects, diseases, and environmental factors which might later be confused with symptoms of possible SO_2 injury. In addition to examining tree and plant foliage on the established areas, foliage was examined at several other locations on the mountain.

Considerations for establishing observation areas include:

1. Presence of a variety of trees and associated plants growing in the area. One phase in evaluating possible SO_2 injury to plants is to determine if similar injury had occurred to a variety of plant species.1/

2. The observation areas should have adequate soil moisture. Plants growing in areas with adequate soil moisture and high humidity are more susceptible to SO_2 injury than plants growing under arid conditions.1/

The sulfation plate station was established in order to get some idea of background sulfation rates. This information, coupled with tree and plant condition observations, may be helpful in the future task of determining whether or not SO_2, emitted by the generating station, has an adverse effect on the forest vegetation growing on Navajo Mountain.

Results.--Trees and plants examined for foliage condition include the following:

Ponderosa pine (Pinus ponderosa)
Pinyon pine (Pinus edulis)
Limber pine (Pinus flexilis)
Douglas-fir (Pseudotsuga menziesii)
White fir (Abies concolor)
Engelmann spruce (Picea engelmannii)

1/ Air Pollution Control Assoc. 1971. Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jacobson, J. S., and A. C. Hill, Editors. Pittsburgh, Pa.

Aspen (Populus tremuloides)
Gambel oak (Quercus gambelii)
Juniper (Juniperus spp.)
Snowberry (Symphoricarpos spp.)

No symptoms caused by insects, diseases, or environmental factors were noted which might later be confused with symptoms of possible SO_2 injury. The most prevalent forest diseases noted were southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) on ponderosa pine; pinyon dwarf mistletoe (A. divaricatum) on pinyon pine; and the true mistletoe (Phorandendron juniperinum) on juniper. A needle mottle or fleck of unknown cause was noted on ponderosa pine needles.

Sulfation plate data for the period June 1971-February 1972 are as follows:

Month	Days exposed	* Sulfation rate (Micrograms $SO_3/cm^2/day$)
Jul. 1971	33	** <Detectable minimum
Aug.	30	<Detectable minimum
Sep.-Oct.	62	<Detectable minimum
Nov.	29	<Detectable minimum
Dec.	33	<Detectable minimum
Jan. 1972	28	<Detectable minimum
Feb.	28	<Detectable minimum

* Corning Laboratories, Inc., Cedar Falls, Iowa, supplies and analyzes all sulfation plates.

** Detectable minimum for 30-day period (micrograms $SO_3/cm^2/day$)
Jun. 1971-Sep. 1971 - 1.0
Oct. 1971-Feb. 1972 - 0.8

Discussion.--This survey is an effort to get some idea of plant condition and sulfation rate on selected areas on Navajo Mountain prior to operation of the Navajo Generating Station. To date, the only locations we have found acute SO_2 injury to Southwestern forest vegetation have been within 4 miles of the source emitting SO_2.[2/] [3/] The Navajo Generating Station is located more than 28 miles from

2/ Loomis, R. C. 1971. Disease Detection Survey, Air Pollution, Tonto National Forest, Arizona; Sierra Ancha Experimental Forest, Arizona. Office Report, USDA, Forest Service, Southwestern Region. 15 p.
3/ Loomis, R. C. 1971. Disease Detection Survey, Air Pollution, Apache National Forest, Arizona. Office Report, USDA, Forest Service, Southwestern Region. 9 p.

Navajo Mountain, and, therefore, the possibility seems remote that SO_2 emissions from this installation will cause injury to forest vegetation. Nevertheless, the possibility that SO_2 emissions could cause acute or chronic injury to vegetation still exists, and, for this reason, a final evaluation should be made after the Navajo Electrical Generating Station begins operation.

The needle mottle or fleck on ponderosa pine has been found in New Mexico and Arizona for many years. This needle marking can be found in areas far from any known sources of air pollution, such as Navajo Mountain, as well as in areas close to industrial activity. We are now attempting to determine if the appearance of this marking is related to a particular time of year. In addition, we are working with Forest Service Research plant pathologists, and members of the University of Arizona Department of Plant Pathology, in trying to determine the cause of this needle marking.

A map is attached which shows the areas included in the 1971 air pollution detection survey.

Recommendations.--Re-establish the sulfation plate station, and conduct a detection survey after the Navajo Electrical Station begins its schedule operation in 1974.

AIR POLLUTION DETECTION SURVEY 1959

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